PROTOCOL

ECOLOGICAL CONSTITUENTS OF POTENTIAL CONCERN SELECTION PROCESS

Introduction

The following protocol has been developed in order to support the Savannah River Site (SRS) environmental remediation program. This protocol provides instructions for the development of a list of ecological constituents of potential concern (COPCs) in the ecological risk assessment (ERA) process. The protocol instructions are based on the latest available Environmental Protection Agency (EPA) guidance, as well as, on input from the staff of EPA Region IV and the South Carolina Department of Health and Environmental Control (SCDHEC). The COPC selection process is the SRS implementation of Steps 1 through 3 of the "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (EPA 1997). When adequate abiotic data are available, the COPC selection process is conducted in the work plan. The COPC selection process is conducted in the baseline ecological risk assessment when adequate abiotic data were unavailable in the work plan or when new abiotic data have been collected since the initial selection process.

The process described below is intended to be applied after application of the "Unit-Source Data Process Protocol," "Unit-Background Data Process Protocol," and the "Surrogates for Non-Detects Protocol." Ecological screening values (ESVs) and toxicity reference values (TRVs) identified in the protocol will be addressed in the "Ecological Screening Values (ESVs)" and "Terrestrial Toxicity Reference Values (TRVs)" protocols, respectively. The appropriate assessment endpoints and their representative receptors to be used in the COPC selection process will be addressed in the "Assessment and Measurement Endpoint Selection Process Protocol." The exposure groups are described in the "Exposure Group Protocol." For the purposes of ecological risk assessment, only the following exposure groups may be evaluated:

- Soil from 0 to 0.3 m (0 to 1 ft)
- Soil from 0 to 1.2 m (0 to 4 ft)
- Surface Water
- Surface Sediments

Prior to implementing the steps presented below, the data for the detected constituents are sorted and grouped by medium and exposure group. The appropriate set of background data for each medium and exposure group is then identified. For example, for the 0 to 0.3 meter soil exposure group, background samples corresponding to the 0 to 0.3 meter soil interval will be used to calculate average background concentrations. For each constituent in each medium or exposure group, constituents are eliminated that have no detects. For each constituent in each medium and exposure group, the following parameters are determined: detection frequency, method detection limit (MDL), minimum detection, maximum detection, average detection, and two times (2x) average background concentration.

Details

The COPC selection process is divided into two components: screening (Steps A and B) and problem formulation (Steps C - G). These steps are described below and presented in Figure 1.

Screening Steps (A and B)

STEP A

The purpose of this step is to determine whether the constituent in each exposure group has an ecological screening value (ESV). [Note: the appropriate ESVs are identified in the protocol for “Ecological Screening Values (ESVs)."] If ESVs are unavailable for a given constituent, the constituent is carried forward to Step C.

STEP B

The purpose of this step is to identify constituents with screening-level hazard quotients (HQs) greater than one. If the maximum media concentration of the constituent divided by its associated ESV (obtained in Step A) is less than one, then it is not of concern for further evaluation in the ERA. These constituents will be identified and dropped from further consideration. If the HQ is greater than one, then the constituent is to be carried forward to Step C.

Problem Formulation Steps (C - G)

STEP C

The purpose of this step is to identify constituents for which background media concentrations can be used to eliminate them from further consideration. For each constituent in each exposure group, compare the maximum constituent concentration to two times the average unit background concentration. Identify the constituent as to whether it is above or below the background value. For surface soil (0 to 0.3 m), the interval is compared to the 2x average surface background concentration. For subsurface soil (0 to 1.2 m), the interval is compared to the 2x average composite (0 to depth) background concentration. For surface water or sediment, the media concentration is compared to the 2x average background concentration of the upgradient or reference background location(s) for surface water or sediment. Drop the constituent if it is less than its associated background value. Otherwise, the constituent is carried forward to Step D. Constituents retained upon completion of Step C are identified as COPCs.

STEP D

The purpose of this step is to identify constituents for which bioaccumulation or bioconcentration may be of concern and should be re-included. For each constituent, determine if the constituent should be retained per the protocol for "Bioaccumulation and Bioconcentration Screening." The constituent is to be carried forward to Step E if it is included in the protocol for "Bioaccumulation and Bioconcentration Screening" and its maximum concentration is greater than 2X average background.

STEP E

The purpose of this step is to identify whether the remaining constituents pose potential risk through direct contact and/or through exposure from ingestion of contaminated media (e.g., biota).

For constituents that pose a potential risk through direct contact, the maximum and average unit media concentrations are identified and carried into Step F.

For constituents that pose potential risk through exposure from ingestion of contaminated media, a daily intake of each constituent is calculated. Conversion of the environmental concentration of each constituent to an estimated daily intake for a receptor at the unit is necessary prior to evaluation of potentially toxic effects. A unit-specific exposure dose of each constituent is calculated using a food chain uptake model consistent with EPA Region IV guidance (EPA 1995) for receptors representing each media of potential concern. The exposure dose (ED) is generated using maximum and average unit media

concentrations and takes into account the unit foraging factor (UFF) and other receptor-specific input parameters (e.g., ingestion rates and body weight). However, the UFF is assumed to be one to ensure conservativeness in this step of the process.

Whether the constituent poses potential risk through direct contact and/or through exposure from ingestion of contaminated media, the following steps are completed.

E.1 Based on the chemicals detected at the exposure unit and their mechanisms of toxicity to unit receptors,, select one or more appropriate assessment endpoints and their associated representative receptors based on the assessment endpoint and receptor selection criteria. [Note: these criteria will be identified in the protocol for "Assessment and Measurement Endpoint Selection Process."] Two types of exposures are distinquished in toxicological assessments: exposures through direct contact with contaminated media and exposure through ingestion of contaminated media (e.g., soil, surface water, sediment, or biota). TRVs for chemicals administered through direct contact are often expressed as concentrations in the abiotic exposure medium. TRVs for chemicals administered through the diet are often expressed as milligrams ingested per kilogram of body weight per day."

E.2 Based on the receptor and constituents identified, select the receptor- and constituent-specific input parameters.

Upon completion of Step E, proceed to Step F.

STEP F

The purpose of this step is to identify constituents with evaluation-level hazard quotients greater than one and to perform a weight-of-evidence evaluation on these constituents based on magnitude of exceedances. The generation of evaluation-level HQs for constituents posing potential risk through direct contact and constituents posing potential risk through exposure from ingestion of contaminated media are described below, respectively.

. For direct contact constituents, compare maximum and average unit concentrations to their associated no observed adverse effects level (NOAEL) and lowest observed adverse effects level (LOAEL)-based TRVs for each exposure group. The evaluation-level HQ is calculated by dividing the unit media concentration by its associated TRV. If all of the evaluation-level HQs are less than the one, then the constituent is dropped from further consideration based on direct contact. If any evaluation level HQ is greater than one for a given constituent, a weight-of-evidence evaluation based on magnitude of exceedances (e.g., NOAEL versus LOAEL, maximum versus average comparisons, and bioavailability considerations) is performed. An evaluation of the effects of using unit-specific UFFs may also be conducted in this step. Direct contact constituents may be eliminated based on these evaluations.

For constituents posing potential risk through ingestion of contaminated media, the evaluation-level HQ is calculated by dividing the ED by the TRV. If all of the evaluation-level HQs are less than the one, then the constituent is dropped from further consideration for ingestion constituents. If any evaluation level HQ is greater than one for a given constituent, a weight-of-evidence evaluation based on magnitude of exceedances (e.g., NOAEL versus LOAEL and maximum versus average comparisons) is performed. An evaluation of the effects of using unit-specific UFFs may also be conducted in this step. Ingestion constituents may be eliminated based on these evaluations.

Constituents remaining upon completion of Step F are further evaluated in Step G.

STEP G

Constituents remaining following completion of Step F are further evaluated using a weight-of-evidence approach in the categories of frequency of detections (i.e., analytical qualifier evaluation) and patterns of detections (i.e., evaluation of background versus unit concentrations). This evaluation is based on an interpretation of the available data, interpretation of the available information, and professional judgement. Constituents remaining upon completion of this evaluation are identified as final COPCs.

Conclusions

Constituents remaining upon completion of the COPC selection process are the final COPCs retained for further evaluation. If no COPCs remain, the ERA process is complete and no further documentation is required. If COPCs remain, the constituents are the starting point of the ecological risk assessment analysis.

References

EPA. 1995. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment.* Draft, Office of Health Assessment, EPA Region IV, Atlanta, GA.

EPA. 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments.* Interim Final, Environmental Response Team, Edison, NJ.

Figure 1. Ecological COPC Selection Process